TITLE OF INVENTION

APPARATUS FOR PROCESSING CALL OF WIRELESS LAN USING CALLBACK FUNCTION AND METHOD THEREOF

CLAIM OF PRIORITY

[0001]   This application makes reference to, incorporates the same herein, and claims all benefits accruing under 35 U.S.C. §119 from an application for *APPARATUS FOR PROCESSING CALL OF WIRELESS LAN USING CALLBACK FUNCTION AND METHOD THEREOF* earlier filed in the Korean Intellectual Property Office on 2 December 2002 and there duly assigned Serial No. 2002-76048.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002]   The present invention generally relates to an apparatus for processing a call of a wireless LAN using a callback function and a method thereof for processing the call between terminals operated on the basis of the wireless LAN, and more specifically to an apparatus for processing a call of a wireless LAN using a callback function and a method thereof for connecting the call when target terminals are converted into a keep-alive state from a keep-dead state (for example, out of an access point (AP) section or power is turned off) by periodically receiving state information of other terminals in a transmitting terminal.

Description of the Related Art

[0003] Recently, as a wireless office telephone service using Wireless Office Solution (WOS) has been regularized, Private Branch exchange (PBX) performing a simple in-house exchange function in the past has almost disappeared. The wireless office telephone service securing mobility as receiving all advantages of an Internet Protocol (IP)-based IP PBX has become influential rapidly in the domestic market along with marketing strategies of mobile communication providers.

[0004] In another words, a Public Switched Telephone Network (PSTN)-based PBX is changed to an IP-based PBX and combined with Code Division Multiple Access (CDMA) technologies, thus enterprises have concretely accomplished cable and wireless integration in themselves.

[0005] Hereinafter, a configuration of a system performing a wireless office telephone service will be more fully described in reference to the accompanying drawings.

[0006] Fig. 1 is a format diagram conceptually illustrating an available access range section between a wireless LAN exchange and terminals.

[0007] As shown in Fig. 1, a wireless office telephone service is performed by installing an AP 20, a wireless LAN (local area network) base station, in an IP-based PBX, which is a wireless LAN exchange 10.

[0008] However, in the above configuration, if terminals (T1~Tn) are out of an available range of the AP 20 , that is, they are located in the same position as a terminal (Ts), it becomes inaccessible. Thus, though the terminals are not busy, there is no way to connect calls.

[0009] In addition, since wireless LAN terminals moving much have a lot of battery consumption capacities, it is easy to use up all power. Therefore, though the terminals are not busy, it is

1 impossible to connect calls owing to power-off states of the terminals.

2 **[0010]** Accordingly, when target terminals (destination terminals or receiving terminals) re-enter

3 the available range after going out of the available range of the AP 20 or power is turned on by

4 changing a battery from a keep-dead state due to a power-off state, a service for automatically

5 connecting calls to the target terminals themselves is requested.

6 # SUMMARY OF THE INVENTION

7 **[0011]** It is therefore an object of the present invention to provide an apparatus for processing a

8 call of a wireless LAN using a callback function and a method thereof for automatically attempting

9 calls to target terminals converted into a keep-alive state from a keep-dead state by each terminal,

10 when the terminals periodically transmit information on the keep-alive state to a wireless LAN

11 exchange and the wireless LAN exchange transmits a telephone number list about keep-dead

12 terminals to the terminals by considering terminals from which a keep-alive signal is not transmitted

13 as the keep-dead terminals.

14 **[0012]** It is another object to provide an apparatus and method for processing a call of a wireless

15 LAN using a callback function that is efficient and easy to implement.

16 **[0013]** It is yet another object to provide an apparatus and method for processing a call of a

17 wireless LAN using a callback function that reduces time wasted by unnecessary manual operations.

18 **[0014]** To accomplish the above and other objects, a method of processing a call of a wireless

19 LAN using a callback function in accordance with the present invention, includes: periodically

20 transmitting a keep-alive signal to a wireless LAN exchange from terminals; considering terminals

1 from which the keep-alive signal is not transmitted as keep-dead terminals, and transmitting an off

2 list about the keep-dead terminals to each terminal by the wireless LAN exchange; attempting calls

3 to target terminals (destination terminals or receiving terminals) to be substantially called from the

4 terminals, and requesting a callback service according to user intentions if telephone numbers of the

5 target terminals are stored in the telephone number list; and automatically attempting the calls to the

6 target terminals from the terminals when the target terminals are converted into a keep-alive state

7 from a keep-dead state, if the callback service is requested.

8 [0015] In addition, to accomplish the above and other objects, in an apparatus for processing a call

9 of a wireless LAN, the apparatus for processing the call of the wireless LAN using a callback

10 function in accordance with the present invention, includes: a terminal composed of a user interface

11 interfacing with a user in order to perform a corresponding command according to a selected

12 operation of the user, a call controller overall controlling calls, a network interface interfacing to

13 physically perform communication between the terminal and a wireless LAN exchange, and a system

14 interface having data on an telephone number list storing a list of keep-dead target terminals as

15 interfacing with a wireless LAN exchange system and having data on a call list storing a call request

16 scheduled list corresponding to telephone numbers to which users request a callback service among

17 telephone numbers of target terminals that fail to attempt calls; and the wireless LAN exchange

18 composed of a call controller overall controlling calls, a terminal interface considering terminals

19 from which a keep-alive signal is not transmitted as keep-dead terminals as interfacing with the

20 terminals and storing a telephone number list of the keep-dead terminals in a terminal state

21 information storage, a network interface interfacing to physically perform communication between

1   the terminal and the wireless LAN exchange, and an AP connected to the network interface in a wire

2   line to enable wireless communication between the wireless LAN exchange and the terminal and

3   transceiving a wireless signal to the terminal.

BRIEF DESCRIPTION OF THE DRAWINGS

5   **[0016]**   A more complete appreciation of the invention, and many of the attendant advantages

6   thereof, will be readily apparent as the same becomes better understood by reference to the following

7   detailed description when considered in conjunction with the accompanying drawings in which like

8   reference symbols indicate the same or similar components, wherein:

9   **[0017]**   Fig. 1 is a format diagram conceptually illustrating an available access range section

10   between a wireless LAN exchange and terminals;

11   **[0018]**   Fig. 2 is a block diagram illustrating main parts of a wireless LAN exchange and a terminal

12   in accordance with one embodiment of the present invention;

13   **[0019]**   Fig. 3 is a conceptual diagram illustrating a procedure of transceiving terminal state

14   information between a wireless LAN exchange and many terminals to apply a callback function by

15   the present invention;

16   **[0020]**   Fig. 4 is a flow chart illustrating a process of transmitting terminal state information to an

17   exchange from a terminal according to one embodiment of the present invention;

18   **[0021]**   Fig. 5 is a flow chart illustrating a process of transmitting state information of other

19   terminals to target terminals from an exchange according to one embodiment of the present

1 invention;

2 [0022] Fig. 6 is a flow chart illustrating a process of transmitting information on an off-terminal

3 of other terminals to target terminals from an exchange according to one embodiment of the present

4 invention; and

5 [0023] Fig. 7 is a flow chart illustrating a process of substantially using a callback function in a

6 terminal according to one embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

8 [0024] The present invention will now be described more fully hereinafter with reference to the

9 accompanying drawings, in which preferred embodiments of the invention are shown. This invention

10 may, however, be embodied in different forms and should not be construed as limited to the

11 embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will

12 be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

13 [0025] The present invention will now be described more fully hereinafter with reference to the

14 accompanying drawings, in which preferred embodiments of the invention are shown, so that this

15 disclosure will be thorough and complete, and will fully convey the scope of the invention to those

16 skilled in the art.

17 [0026] 'Target terminals' described in the present invention mean destination terminals (receiving

18 terminals) to which users want to make calls.

19 [0027] Fig. 2 is a block diagram illustrating main parts of a wireless LAN exchange and a terminal

20 in accordance with one embodiment of the present invention.

1 **[0028]** First, as shown in Fig. 2, the wireless LAN exchange and a terminal system in accordance

2 with one embodiment of the present invention includes: a terminal (Tn) composed of a user interface

3 110, a call controller 120, a network interface 140, and a system interface 130; and a wireless LAN

4 exchange 10 composed of a call controller 12, a terminal interface 13, a network interface 14, and

5 an AP (Access Point) 20.

6 **[0029]** The user interface 110 of the terminal (Tn) interfaces with a user to perform a

7 corresponding command according to a selected operation of a user, and the call controller 120

8 controls the calls overall. The network interface 140 interfaces to physically perform communication

9 between terminals (T1~Tn) and the exchange 10.

10 **[0030]** The system interface 130 interfaces with the wireless LAN exchange 10, and has data on

11 an off list 131 storing a list of all keep-dead terminals and data on a call list 132 storing a call request

12 scheduled list corresponding to telephone numbers to which a call back service is requested by a user

13 among telephone numbers of target terminals that fail to attempt calls.

14 **[0031]** The call controller 12 of the wireless LAN exchange 10 overall controls calls, and the

15 network interface (14) interfaces to physically perform communication between the terminals

16 (T1~Tn) and the exchange (10). The AP (20) is connected to the network interface (14) in a wire line

17 to enable wireless communication between the wireless LAN exchange (10) and the terminals

18 (T1~Tn), and transceives a wireless signal to the terminals (T1~Tn).

19 **[0032]** The terminal interface (13) interfaces with the terminals (T1~Tn), and considers terminals

20 to which a keep-alive signal is not transmitted as keep-dead terminals. An off list about the

21 keep-dead terminals is stored in a terminal state information storage 13'.

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[0033] Generally, a callback function is supplied to an existing cable telephone system. With this function, when a respondent or the other party is busy on the line, a call is automatically connected later by leaving a contact telephone number. Also, this function is supplied from a cell center or a PBX.

[0034] However, the callback function in the present invention is transformed to automatically attempt calls from terminals, when target terminals are converted into a keep-alive state from a keep-dead state.

[0035] Hereinafter, a basic concept of a callback service by the present invention will be described as follows.

[0036] Fig. 3 is a conceptual diagram illustrating a procedure of transceiving terminal state information between a wireless LAN exchange and many terminals to apply a callback function by the present invention.

[0037] As shown in Fig. 3, when a terminal (T1) or a terminal n (Tn) periodically transmits a keep-alive signal to a wireless LAN exchange 10, the wireless LAN exchange 10 stores state information of a responding terminal in a terminal state information storage 13', and upgrades off list information on terminals that do not respond to the signal based on the stored information.

[0038] At this time, as shown in Fig. 1, a keep-alive signal is transmitted to a wireless LAN exchange 10 through an AP 10 unless terminals (T1~Tn) within an available section of the AP are powered-off or busy.

[0039] On the contrary, since a terminal (Ts) out of the available section of the AP does not receive the keep-alive signal in the AP (20), though the signal is transmitted, the wireless LAN

1 exchange (10) processes the terminal (Ts) as a keep-dead state.

2 **[0040]** Thus, the wireless LAN exchange (10) considers the terminal (Ts) to which the keep-alive

3 signal is not transmitted as a keep-dead terminal, and transmits an off list of the keep-dead terminal

4 to all the terminals (T1~Ts).

5 **[0041]** After terminal information is periodically transceived between the terminals (T1~Tn) and

6 the wireless LAN exchange (10), when users attempt to make calls to target terminals to be

7 substantially called, the calls cannot be made at present if telephone numbers of the target terminals

8 are stored in an off list 131. Thus, a callback service is requested or the calls are given up according

9 to a user's intention.

10 **[0042]** If the users request the callback service, the terminals automatically attempt to make calls

11 to the target terminals when the target terminals are converted into a keep-alive state from a

12 keep-dead state.

13 **[0043]** Fig. 4 is a flow chart illustrating a process of transmitting terminal state information to an

14 exchange from a terminal according to one embodiment of the present invention.

15 **[0044]** Hereinafter, among the above conceptual operation relations, a process of transmitting

16 terminal state information to an exchange from terminals will be described in reference to Fig. 4.

17 **[0045]** First, when a keep-alive transmission period has come (S41), each terminal transmits a

18 keep-alive signal to a wireless LAN exchange (10), so that the wireless LAN exchange 10 knows

19 state information of each terminal (S42).

20 **[0046]** The wireless LAN exchange 10 stores telephone numbers about terminals (T1~Tn) to

21 which the keep-alive signal is transmitted and a terminal (Ts) to which the signal is not transmitted

in a terminal state information storage (13'), and upgrades contents of the terminal state information

storage (13') every keep-alive transmission period (S43).

[0047]   Fig. 5 is a flow chart illustrating a process of transmitting state information of other

terminals to target terminals from an exchange according to one embodiment of the present

invention.

[0048]   Hereinafter, among the conceptual operation relations, a process of transmitting an off list

to terminals from an exchange will be described in reference to Fig. 5.

[0049]   When other terminal information transmission period has come S51, a wireless LAN

exchange 10 considers terminals to which a keep-alive signal is not transmitted as keep-dead

terminals based on contents stored in a terminal state information storage 13', and transmits an off

list about the keep-dead terminals to all terminals S52.

[0050]   Each terminal receives the off list from the wireless LAN exchange 10 by the step 'S52',

and upgrades contents of the off list 131, S53.

[0051]   Fig. 6 is a flow chart illustrating a process of transmitting information on an off-terminal

of other terminals to target terminals from an exchange according to one embodiment of the present

invention.

[0052]   Hereinafter, among the above conceptual operation relations, a process of making calls by

substantially attempting the calls by users will be described in reference to Fig. 6.

[0053]   First, users attempt calls to target terminals by pressing telephone digits of the target

terminals S61.

[0054]   It is comparatively decided whether the telephone numbers of the target terminals for calls

1 requested by a terminal are stored in an off list corresponding to a keep-dead state S62. If the

2 telephone numbers of the target terminals are not stored in the off list, a normal call processing

3 procedure is performed S66.

4 **[0055]** If the telephone numbers of the target terminals are decided to be stored in the off list in

5 the step S62, the users are informed by the terminal displaying a keep-dead state to the users through

6 a user interface 110 S63.

7 **[0056]** When the users recognize the keep-dead state, a menu screen for requesting a callback

8 service is displayed so that the users can select whether to use the callback service S64.

9 **[0057]** If it is decided that the users request the callback service in the step 64, a telephone number

10 of a present target terminal is stored in a call list 132 meaning a call request scheduled list S65.

11 **[0058]** While the users request the callback service like above, if a terminal is converted into a

12 keep-alive state from a keep-dead state later, a transmission terminal automatically attempts a call

13 to the target terminals.

14 **[0059]** Such process will be described as follows in reference to Fig. 7.

15 **[0060]** Fig. 7 is a flow chart illustrating a process of substantially using a callback function in a

16 terminal according to one embodiment of the present invention.

17 **[0061]** A terminal periodically compares an off list 131 with a call list S71, and comparatively

18 decides whether a number of call list 132 numbers is not stored in the off list 131 S72.

19 **[0062]** For a call requesting the callback service, the step S72 is performed to know whether a

20 number converted into a keep-alive state from a keep-dead state is generated.

21 **[0063]** If any changes do not occur in the off list numbers in the step S72, it means there is no

1   number converted into the keep-alive state from the keep-dead state. Thus, it returns to the step S71

2   since it is unnecessary to use the callback service.

3   **[0064]**   If it is decided that a number of the call list numbers is not stored in the off list, it means

4   that there is a number converted into the keep-alive state from the keep-dead state. Thus, a call

5   controller 120 of the terminal attempts a call to a corresponding target terminal in order to perform

6   the callback service S73.

7   **[0065]**   The terminal comparatively decides whether to be connected with the target terminal S74.

8   If the terminal is connected with the target terminal, a user makes the call S75.

9   **[0066]**   When the call is terminated after the user sufficiently speaks by telephone S76, the call is

10   terminated by the callback service. Therefore, a system interface 130 of a terminal (Tn) deletes a

11   telephone number of the target terminal to which the present call is made from a call request

12   scheduled list (call list) S77.

13   **[0067]**   If telephone calls applying the callback service are smoothly made in such a way, it is

14   possible for users to automatically attempt the calls when target terminals are converted into a

15   keep-alive state from a keep-dead state without attempting the calls to the keep-dead target terminal

16   many times.

17   **[0068]**   It is to be understood that changes and modifications to the embodiments described above

18   will be apparent to those skilled in the art, and are contemplated. It is therefore intended that the

19   foregoing detailed description be regarded as illustrative rather than limiting, and that it be

20   understood that it is the following claims, including all equivalents, that are intended to define the

21   spirit and scope of this invention.

[0069]   As described so far, according to the present invention, it is possible to supply a callback service under a wireless LAN environment. Accordingly, user terminals themselves can attempt calls to target terminals converted into a keep-alive state without requiring another time for attempting the calls to the target terminals by manual operations. So, users do not have to waste time owing to call attempts without unnecessary manual operation, thereby increasing user convenience.

[0070]   In addition, terminals themselves attempt calls by checking a state of target terminals. Thus, a system, that is, a wireless LAN exchange does not have any specific load.